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United States Department of Agriculture,

BUREAU OF ENTOMOLOGY,

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THE WESTERN GRASS-STEM SAWFLY.

(*Cephus occidentalis* Riley and Marlatt.)

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INTRODUCTION.

The western grass-stem sawfly (*Cephus occidentalis* Riley and Marlatt), which has caused much alarm and not a little loss to the wheat growers of North Dakota during the season of 1909, is not by any means a new insect, although this is its first appearance in the

FIG. 1.—Western grass-stem sawfly (*Cephus occidentalis*): *a*, Larva; *b*, female sawfly; *c*, grass stem showing work. *c*, Enlarged; *a*, *b*, more enlarged. (From Marlatt.)

United States as a serious pest. It was first observed in 1890 and has since been reported at intervals as feeding upon grasses and occasionally upon wheat in Canada and the United States. For the purpose of affording farmers all available information relative to the

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pest this circular has been prepared. The account of the habits and seasonal history of the insect, list of food plants, and description of both larva and adult represent the work of the many observers mentioned in the paragraph on history and distribution, as do also the closing statements as to natural checks upon its increase, and preventive treatment.

HISTORY AND DISTRIBUTION.

The first observation on this insect was made by Mr. Albert Koebele,[a] an agent of this office, who found the larvæ burrowing in grass stems in California in 1890, and who reared the adults. From these and others which had been collected in Montana and Nevada the species was described by Riley and Marlatt, who said: "The economic importance of this species arises from the fact that it may be expected at any time to abandon its natural food plant in favor of the small grains, on which it can doubtless successfully develop. Such changes in the food habits of our native insects are constantly occurring to the great detriment of our agriculture, as is illustrated by the attack of the *Nematus* and *Dolerus* species on wheat, these insects normally affecting wild grasses."

The fulfillment of this prophetic suggestion was not long delayed. In 1896 the late Dr. James Fletcher,[b] entomologist to the Dominion of Canada, reported that he had found the adults, which he believed were those of *Cephus pygmæus* L., the European species, at Indian Head, Northwest Territories [Saskatchewan], and that Mr. John Wenman, of Souris, Manitoba, had sent in wheat straws containing larvæ. Mr. Wenman wrote that the damage resulting from this attack was not appreciable. In 1902 Doctor Fletcher[c] found the larvæ numerous in grasses in the Northwest. In 1905, 1906, and 1907 the junior author observed the work of the larvæ in grasses throughout the northwestern United States, and in 1906 found them damaging wheat at Kulm, N. Dak. In his report for the year 1908 Doctor Fletcher again referred to this insect, stating that in the previous autumn it had appeared in central Manitoba and the southeastern part of Saskatchewan in much more serious numbers than at any previous time. "The broken straws which resulted from its attacks were seen in many fields and occasioned some alarm." Mr. Norman Criddle[d]—a farmer and careful observer of insects, of Aweme, Manitoba, and the inventor of the grasshopper poison which bears his name—recognized the insect as *Cephus occidentalis*, and wrote Doctor Fletcher at the end of the season that the species had increased

[a] Insect Life, Vol. III, p. 71, 1890.

[b] Ann. Rep. Exp. Farms Canada f. 1896, pp. 229–230, 1897.

[c] Letter.

[d] Ann. Rep. Exp. Farms Canada f. 1907–8, pp. 191–192, 1909.

considerably during the last year or two and had turned its attention to wheat and rye. In 1908 the authors found it in grasses in the Willamette Valley in Oregon. In 1909 Prof. H. B. Penhallow, of New York City, writing from Sherwood, N. Dak., stated that it was damaging from 5 to 25 per cent of the wheat in many fields in the Souris Valley, and Mr. R. W. Sharpe, of Fargo, N. Dak., reported similar depredations in the Red River Valley. Larvæ or adults have been found in Manitoba, the Dakotas, Nebraska, Kansas (probably), Saskatchewan, Montana, Wyoming, Colorado, Oregon, Nevada, and California.

HABITS AND SEASONAL HISTORY.

In Manitoba, according to Mr. Criddle,[a] the eggs are laid singly by the female sawfly (fig. 1, *b*) upon a stem of grass or wheat, not far from the head, between June 20 and the second week of July. "The larvæ (fig. 1, *a*) soon hatch and begin to eat down inside the stem, usually reaching the ground toward the end of August, at which time they mature." They then cut a horizontal ring on the interior of the stem near the surface of the ground so as nearly to sever it, after which they close the cavity below smoothly with a plug of castings and spin a thin, silken, cylindrical cocoon below the plug (fig. 1, *c*). The stem usually breaks off neatly at the engraved ring during the autumn, but may remain in position until winter and possibly longer. "In these retreats," to quote again from Mr. Criddle, "the larvæ pass the winter and remain in an active condition unchanged until May of the following year, when they turn to pupæ, and emerge as perfect sawflies toward the end of June, the date varying somewhat with the season." The adults were taken by Doctor Fletcher,[b] July 5, on the flowers of tumbling mustard.

The injured stem appears discolored between the first and third joints and the larva may be seen through the translucent wall of the stem where it is eaten thinnest. In the case of wheat, the stalk often bends at this point, an inch or two below a joint rather than above as in Hessian fly injury, and the head falls to the ground shortly before harvest. Dr. J. H. Comstock[c] found that the European corn sawfly, an allied species, did not affect the size of the head or of the kernels, but it is well known that grasses have the heads blighted by our species, and Professor Penhallow writes that the heads of wheat are shrunken owing to the diversion of sap at this critical time. If this be generally true, the damage to the crop is much greater than has been estimated from the number of fallen heads. Mr. Criddle[a]

[a] Ann. Rep. Exp. Farms Canada f. 1907–8, pp. 191–192, 1909.

[b] Ann. Rep. Exp. Farms Canada f. 1896, pp. 229–230, 1897.

[c] Bul. 11, Cornell Univ. Agr. Exp. Sta., November, 1889.

states that in a field of wheat at Aweme, Manitoba, 75 per cent of the infested stems collapsed before harvest, but we observed a field at Kulm, N. Dak., to have only 6 per cent of the injured straws broken. The native grasses do not collapse when attacked by this insect and it is possible that some stiff-stemmed wheats may stand up better than other varieties. This is an advantage to the farmer in preventing total loss of the affected heads, but a disadvantage if it prevents him from detecting the cause and extent of a serious shrinkage of the kernels.

The damage has been confined heretofore to the edges of fields bordered by grass lands or roadsides. Mr. Criddle[a] states that 50 per cent of the stand is infested for a distance of 100 feet into the fields, and that the damage is apparent to a lesser extent throughout the crop. He also states that the insect seeks wheat only when it fails to find enough flowering stems of grasses in which to deposit its eggs. Recent reports from North Dakota indicate that the injury may be more general than heretofore and suggest that the insect has probably adapted its habits to conform to the farm methods of that region so that it no longer depends upon native grasses but breeds throughout the fields, at once distributing the damage more evenly and increasing its capacity for harm. A pest which can take advantage of wild food plants and yet be independent of them is far more dangerous than one which can feed only upon wheat or one which requires both wheat and a native grass.

FOOD PLANTS.

This sawfly is a native insect which has learned to attack wheat and, according to Mr. Criddle, rye also, since these have taken the place of its native food plants—quack grass and wheat grass (Agropyron), brome grass (Bromus), rye grass (Elymus), and timothy (Phleum). It was especially abundant in Agropyron along railroad embankments in North Dakota in 1905 and 1906, so that in many clumps of this grass one-half of the heads were prematurely whitened.

DESCRIPTION.

The larva (fig. 1, *a*) is about three-fifths of an inch long and one-eighth as wide, slightly larger near the head, and tapering toward the tail, which ends in a small, blunt, upturned, brown tubercle. The body is yellowish white; the head, a spot on the back of the neck, rings on the palpi, the tips of the paired cerci, and the setæ on the last segment, are pale yellow; the margin of the cheeks and of the antennal segments, a faint streak on each cheek through the eye, the mandibles, the stigmata, and the median anal tubercle, are mahogany

[a] Loc. cit.

brown; the mandibles shade to black at the tips and at the hinges; the eyes are black.

The adult (fig. 1, *b*) is a black, shining, four-winged sawfly, about one-third of an inch long, spotted and banded with yellow. The original description[a] is as follows:

The adult insect agrees almost exactly with *Cephus pygmæus* in coloration, coming much closer to it in this respect than to any other American species, but is in every way more slender and graceful and would never be mistaken for the European species. The head is narrower in proportion to the body and is more globular when viewed from the side. Viewed from above it narrows more posteriorly from the eyes than *pygmæus*. * * *

The species may be characterized as follows:

♀ Black; basal joints of the maxillary palpi, large spot on mandibles, two spots beneath anterior wings, membranous regions of thorax, small spot on lower posterior edge of dorsum of first segment, larger one on second segment, band, dentate on basal margin, on apical half of dorsum of third, fifth, and sixth segments, and more or less of the lower and apical margin of the remaining segments, lemon yellow.

Legs black, slender; spot on posterior coxæ above, upper side and tip of femora, yellow; tibiæ and tarsi reddish yellow except tips of posterior tibiæ and their tarsi, which are brownish; last joint and claws of middle and anterior tarsi also brownish.

Antennæ 20–21 jointed, longer than head and thorax, slender to joint 7, beyond which the articles are shorter and thickened.

Wings slightly smoky; veins brown except costal and margin of stigma, which are yellowish; a small infuscated spot at base of discoidal vein; second recurrent vein joins the third submarginal cell near the base of the cell; cross veins of lanceolate cell slightly curved and oblique.

Abdomen not much longer than head and thorax, strongly compressed laterally.

Length, 9–11 mm.

Exp. al., 16–19 mm.

♂ smaller and more slender than the ♀; abdomen less compressed; antennæ 18–21 jointed. Coloration as in ♀ except a large spot on the clypeus, one just below the eyes in front, the entire pectal region of the thorax, and the posterior margin of the third, fifth, and remaining ventral segments, which are lemon yellow.

The under side of the coxæ, trochanters, and femora, including the apex of the latter above, are lemon yellow; the tibiæ and tarsi are as in the case of the ♀.

In some specimens the femora are entirely yellow or with a narrow black line on the anterior pair above, and the yellow band on the third ventral segment is occasionally obsolete.

Length, 8–9 mm.

Exp. al., 15–17 mm.

Habitat: Santa Clara County and Santa Cruz Mountains, California, Nevada, and Montana.

Described from 24 females and 14 males, of which 25 specimens from California were bred by Mr. Koebele, and 13 from Nevada and Montana were collected.

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[a] Insect Life, Vol. IV, pp. 177–178, 1891.

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NATURAL CHECKS.

Mr. Criddle found that many of the broken stems of infested wheat had bent in such a way as to crush and kill the larva which was working at the point where the stem collapsed. Since the stems of grasses do not break under the attack, this is a danger which the insect has incurred by changing to a new food plant. This form of accident materially reduces the number of individuals which may reach maturity and deposit eggs in the wheat, since from 6 to 75 per cent of the infested stems break near the point where the larva is working, shortly before the larva retreats toward the roots to prepare for hibernation.

Parasites were reared by the junior author from larvæ collected at Minot, N. Dak., belonging to an undescribed species of the Chalcidid tribe Entedonini.

PREVENTIVE MEASURES.

Mr. Criddle tried burning the stubble in the autumn with the aid of straw scattered over it, but found that the larvæ were not much damaged thereby. A remedy which suggests itself and has been practiced to some extent is the plowing down of all stubble, either in autumn or before June 15, at which time the adults may be expected to emerge and deposit eggs. Grass growing near the edges of fields should be mowed early in July, while the larvæ are small, to prevent them from maturing and attacking the crop of the following year.

Approved:

JAMES WILSON,

Secretary of Agriculture.

WASHINGTON, D. C., *December 24, 1909.*

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